Pilot's Guide for the Genesis ™

Electronic Standby Instrument System

ESI-500 / MAG-500

Avionics Systems

GENESIS

ELECTRONIC STANDBY INSTRUMENT

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Avionics Systems

Distributed by:

L-3 Avionics Systems
5353 52nd Street, S.E.
Grand Rapids, MI 49512 USA
Customer Support (800) 453-0288
International (616) 949-6600
FAX (616) 977-6898
www.l-3avionics.com

Document Precedence

This Pilot's Guide provides general information about the operation of the ESI-500 and the optional MAG-500. Refer to your FAA-approved Airplane Flight Manual (AFM) and its flight manual supplements for information specific to your aircraft. If there is conflicting information between the AFM and this guide, the AFM takes precedence over this guide.

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Revision Notice

Revision B to this Pilot's Guide incorporates Software 1.1.

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List Of Abbreviations and Acronyms

°	Degree
3D	3 Dimensional
ADS	Air Data Sensor
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
ALT	Altitude
ATT	Attitude
BARO REF	Barometric Reference
BATT	Battery
B/C or BC	Backcourse
BRT	Bright
CAL	Calibration
CRS	Course
DCM	Data Configuration Module
DO	RTCA Document
DTED	Digital Terrain Elevation Data
E	East
EAR	Export Administration Regulations
ESIS	Electronic Standby Instrument System
FAA	Federal Aviation Administration
FPM	Feet Per Minute
ft	Feet
FPM	Feet Per Minute
FR	From
GPS	Global Positioning System
HDG	Heading
HPA	Hectopascals
Hz	Hertz
IAS	Indicated Airspeed
ID	Identification
ILS	Instrument Landing System
Ident	Identification
lbs	pounds
IM	Inner Marker Beacon
IN	Inches of Mercury
lbs	pounds
kt/kts	Knot(s)
LOC	Localizer
M	Menu (Button)
MAG/mag	Magnetometer
Max	Maximum
mB	Millibars
MHz	Mega Hertz

List Of Abbreviations and Acronyms

MM	Middle Marker Beacon
min	Minutes
MPH	Miles Per Hour
NAV	Navigation
NM or nmi	Nautical Miles
OM	Outer Marker Beacon
PREV	Previous
P/N	Part Number
QFE	Altitude Above Ground
QNE	Barometric Pressure for Standard Altimeter Setting
QNH	Barometric Pressure for Local Altimeter Setting
REF	Reference
REQ	Required
RTC	Real Time Clock
SEL	Select
SN	Unit Serial Number
SRC	Source
STD	Standard Pressure Barometric Setting
SW VER	Software Version
SYS ID	System Identification
SYS STATUS	System Status
SynVis	Synthetic Vision
SVS	Synthetic Vision System
TRK	Track
TSO	Technical Standard Order
UTC	Universal Time Code
Vcaution	Start Speed Of Caution Range
Vmo	Maximum Operating Speed
Vne	Never Exceed Speed
Vno	Maximum Structural Cruising Speed
Vs0	Minimum Steady Flight Speed
Vs1	Stalling Speed
VAC	Volts Alternating Current
VDC	Volts Direct Current
VPWM	Voltage Pulse Width Modulation
W	Watts
W	West
WP	Waypoint
U.S.	United States
VFR	Visual Flight Rules

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CHAPTER 1
DESCRIPTION

Introduction

The Electronic Standby Instrument System is comprised of the panel mounted ESI-500 Electronic Standby Indicator and the optional remote mounted MAG-500 Magnetometer. The system provides the flight crew with the display of attitude, slip, altitude, airspeed, and heading. The ESI-500 provides a means of setting barometric correction and adjusting the display brightness. In addition, functional upgrades are available for navigation information and the display of synthetic vision, including terrain and obstacles.

The ESI-500 is comprised of the following integral components: Active Matrix Liquid Crystal Display, menu push button, a rotating knob with push button, ambient light sensor, battery pack, solid state rate sensors, accelerometers, and pressure transducers. A micro-SD card slot is located on the front bezel and is used for software and database updates. Pitot/Static port connections and one 44 pin connector is located in the rear of the unit. Refer to Figure 1-1.

Figure 1-1: ESI-500

Functional Description

The ESI-500 has interfaces for input and output of ARINC-429 data, discrete output, outside air temperature input, dimming bus, RS-485 interface between the ESI-500 and MAG-500, and an I_2C interface to the DCM-500.

The battery pack automatically powers the ESI-500 without interruption upon loss of main input power. The battery pack has three lithium ion cells that are recharged using aircraft power. The battery pack includes monitoring and safety functionality that provides continual operational checks and oversight of operation to ensure the battery cannot be overcharged, overly depleted or detrimentally charged due to temperature limitations.

Pitot and static pressures are measured through pitot and static ports located on the rear of the unit.

The Data Configuration Module (DCM-500) is a solid-state device that retains software and hardware configuration information for the ESI-500. The DCM-500 is permanently attached to the aircraft via the wiring harness.

A magnetometer (MAG-500) or an ARINC-429 heading source is required for the optional display of heading.

Synthetic Vision is a 3-dimensional display of terrain and obstacles, based on GPS location of the aircraft, attitude, altitude, and heading. Synthetic Vision provides situational awareness to the pilot by providing a means to aid in visually acquiring potential impact threats of terrain and obstacles. Synthetic vision uses a terrain database consisting of DTED (digital terrain elevation data) and an obstacles database for the display of obstacles. Terrain is shaded to give dimension to the terrain, water is shown in blue, and gridlines are shown to aid in determining relative distances.

If the aircraft does not already have a TAWS or Terrain alerting system installed, the Synthetic Vision should be configured to display alert shading (red and yellow) of the 3D terrain display, for caution and warning annunciations of terrain or obstacle impact.

The navigation function can be configured for VOR/ILS or GPS or both. The VOR/ILS provides the following display indications: VOR/ILS Indications, Navigation Source, Selected Course, To/From Indicator (VOR), Lateral Deviation, BC Annunciation (Auto detected with a heading input), Vertical Deviation (ILS), and Marker Beacon.

The GPS provides the following display indications: Navigation Source, Selected Course, Lateral/Vertical Deviation, To/From indication, and Desired Track.

Limitations

1. When configured to operate with a MAG-500 for heading reference input; the use of heading is not authorized to operate in the following regions due to magnetic field unsuitability:
   - North of 70° N latitude
   - South of 70° S latitude
   - North of 65° N latitude between 75° and 120° W longitude (northern Canada)
   - South of 55° S latitude between 120° and 165° E longitude (south of Australia and New Zealand)

   The heading will fail if the magnetic dip angle exceeds 82º.

   Attitude and air data information is still usable.
2. Battery operation is inhibited due to low and high temperatures as follows:
   - Battery will not discharge when temperature is: > +65°C (> +149°F)
   - Battery will not charge when temperature is:< +5°C and >+40°C (<+41°F and >+104°F)
   - Battery capacity not guaranteed when battery temperature is < -20°C (<-4°F). Battery may not be available when battery temperature is < -20°C or > +60°C (<-4°F or >+140°F)
   - Storage or operation in extreme high temperature >+90°C (>+194°F) may cause the chemical fuse in the Battery Pack to permanently disable the battery

   Battery operation can also be inhibited due to low input voltage. Refer to the troubleshooting section for corrective actions.
3. The Synthetic Vision (SVS) option has the following limitations:
   - Areas with densely populated objects (exceeds 500 objects in a ¼ degree square area) and are >200ft AGL may not show all obstacles on the display (e.g. windmill farms).
   - The Synthetic Vision alert function (red and yellow shading of the 3D terrain display) does NOT meet the requirements of TSO-C151 (TAWS) or TSO-194 (HTAWS).
   - The Synthetic Vision function only works when the aircraft is between 70° N and 70° S.
   - For QFE operation the Synthetic Vision must be disabled in the menu.

Limitations (continued)

4. When air data is failed, the ESI-500 can operate in an Attitude Degraded Mode, which means that the ESI-500 is not operating within the normal performance parameters. The pilot is alerted to this by an amber “ATT DEGRADED” message on the display.
   - When air data is failed, heading is invalid.

Specifications

GENERAL	
Weight:	2.75 Lbs (1.25 kg) MAX
View Area and Angles:	Display has a viewable area of 3.5 in diagonal (70.56mm x 52.92mm) Primary viewing angle range of +/- 35° in the horizontal plane and -20/ +30° in the vertical plane.
DISPLAY RANGE	
Attitude:	Pitch +/- 90°, Roll +/-180°, Yaw 0° to 360°
Altitude:	Tape and Digital Readout range (-1,500 to 35,000 ft.) Metric Readout range (-456 to 10,668 m)
Airspeed:	Tape Viewable Range: 80 units (kts / mph) Tape and Readout Limit, 20 to 300 kts (23 to 345 mph)
Baro Value:	InHg: (16.00 to 32.50) STD 29.92 HPA: (542 to 1,100) STD 1013 MB: (542 to 1,100) STD 1013
OPERATION LIMITS	
Vertical Speed:	Altitude Rate up to ± 9,900 ft/min
Slip Accuracy:	Range +/- 12°, accuracy +/-2°. No turn rate, no standard turn bank angle.
Computed Air-speed:	Up to 300 kts (345 mph)

Specifications (Continued)

Heading:	Normal Performance for MAG-500 Installation • Static heading error will not exceed +/-2.0° • Dynamic heading error will not exceed +/- 6.0° Degraded Performance for MAG-500 Installation (when the “HDG DEGRADED” indication is shown) • Static heading error will not exceed +/- 12.0° • Dynamic heading error will no exceed +/- 24.0° Latitude limits: +/- 70°. Dip angle exclusions for Northern Canada and South of Australia. The heading will fail if the magnetic dip angle exceeds 82°. When installed with External 429 Heading, performance is based on External LRUs performance requirements. Display error for external heading is within +/- 1.0° of heading source.
Attitude:	Normal Performance • Static pitch or roll ±1.0° • Dynamic pitch or roll ±2.5° Degraded Performance (when the “ATT DEGRADED” indication is shown) • Static Pitch +/-3° and Roll +/- 4° • Dynamic Pitch Accuracy is less than or equal to +/-6.0° in the range of +/-10.0° and outside of +/-10.0°, the pitch is in the correct direction. • Dynamic Roll Accuracy is less than or equal to ±8.0° in the range of +/-25.0° and outside of +/-25.0°, the roll is in the correct direction. Pitch, Roll, Yaw Rate: +/- 300°/second

Specifications (Continued)

BATTERY PERFORMANCE	
Capacity:	Provide at least 1 hour of power backup if maintained and charged. Capacity Minimum: 1 hour when temperature is -20°C to +60°C (-4° to +140°F).
Battery, Discharge Temperature:	< +65°C (< +149°F)
Battery, Charging Temperature:	Between +5°C and +40°C (+41°F and +104°F)
Battery Availability:	Battery may not be available when battery temperature is <-20°C or > +60°C (<-4° or <+140°F). Storage or operation in extreme high temperature >+90°C (>+194°F) may cause the chemical fuse in the Battery Pack to permanently disable the battery.
Scheduled Maintenance:	Battery calibration once a year. Subject to requirements of 14 CFR 91.411.
Service Life:	The ESI-500 has unlimited service life. The battery has approximately 5 years of service life; provided that the procedures for maintenance are followed as detailed in the Battery Capacity Calibration Procedure.
Shelf Life, Battery:	The battery has a 5 year shelf life. The shelf life is shortened if the battery is stored at temperatures greater than +21ºC (+70ºF).

CHAPTER 2
OPERATION

Introduction

This chapter describes the operation of the Electronic Standby Instrument System. Details for display elements are provided in Chapter 3.

Pilot Advisory

For ESI-500 functions that require data from an external source, the pilot should be familiar with the equipment that is providing the data. For example, which GPS provides the data for the Synthetic Vision and the GPS navigation displays, which NAV receiver provides the data for VOR/ILS displays, and if heading data is not provided from the MAG-500, what equipment is providing the heading or track data for the direction display. This will help the pilot to understand how these ESI-500 functions are affected by their source equipment, such as failures of the source equipment or how different modes of operation of the source equipment can affect the ESI-500 displays.

Power On

1. Depending on the aircraft use either the battery switches or avionics master switch to apply power.
2. The indicator transitions through the startup sequence (Self Test and System Identification).
3. The unit will begin normal start up displaying the splash screen followed by the database acknowledgement screen (if applicable).
4. If applicable press the Menu button to continue startup.
5. The unit transitions to normal mode operation beginning with aligning attitude.
6. The alignment of attitude may require up to three minutes to complete. The attitude message and progress bar remain showing on the page until the unit is properly aligned. Refer to Figure 2-1.
7. After alignment is complete the unit is in normal operation mode.

Splash Screen

The Splash screen provides the following information: System Name, System Type No., Software part number, Firmware part number, and if detected a DCM-500 error message.

Database Acknowledgement Screen

This screen is shown only if the Synthetic Vision option is enabled via the option activation. The Database Acknowledgement screen displays the following information: Terrain database name, terrain database effective date, obstacle database name and cycle, obstacle effective date, obstacle expiration date, and any disclaimer.

Alignment

The ATT ALIGNING message is shown in the center of the screen with a green progress bar below it. Refer to Figure 2-1. It is active when the ESI-500 first enters normal operation. Refer to Figure 2-2.

The alignment of attitude may require up to three minutes to complete depending on the motion of the aircraft. The attitude message and progress bar remain showing on the screen until the unit is properly aligned.

During alignment heading is invalid and navigation information is removed from the screen (if applicable).

CAUTION *In-air alignment should only be performed during straight and level flight without acceleration.*

Figure 2-1: Example of Attitude Aligning

NOTE

Alignment accuracy depends on current flight conditions and the ability to maintain straight and level flight throughout the alignment process. During abnormal conditions, such as high turbulence, the unit may not be able to align. The status bar may show negative progress and/or hold at zero progress until conditions improve.

Normal Operation

An example of the ESI-500 in normal operation is shown in figure 2-2. Display features such as heading tape/readout, vertical speed readout, metric readout, and navigation information are configurable and shown for reference only.

Figure 2-2: Example of Normal Display

Increase Display Brightness

When the pilot menu is not active, pressing and holding the Menu button will increase the display brightness. Use the pilot menu item 'Set Brightness Offset' to adjust the brightness level.

Adjust Barometric Pressure

Adjust barometric pressure by rotating the knob when the pilot menu is not active.

Millibars (MB) and Hectopascals (HPA) are adjusted in increments of 1.0 and Inches of Mercury (IN) are adjusted in increments of 0.01.

Press the knob to set the Standard Pressure Barometric Setting (29.92 In.Hg, 1013 hPa, 1013 mb) when the menu is not active. The barometric setting display will show 'STD'.

Pilot Menu

Press the Menu button to open the Pilot Menu across the lower portion of the display. The heading and some navigation data located at the bottom of the screen are hidden while the menu is open.

Rotate the knob to scroll the menu left or right. The active menu item is centered on the scroll bar and has cyan text. Menu items that have gray text are not selectable.

Pressing the knob initiates a change to the menu item option. The main menu shifts up, and becomes the sub menu title, the sub-menu slides in from bottom and is displayed below the title.

This sub-menu provides only one line of data and has a cyan knob icon to the right of numeric entry items indicating that turning the adjustment knob changes the sub-menu item and initiates the change.

Some menu items require a confirmation, have multiple selections, have numeric entries, or are system information menus with sub-menus. These menu items are followed by "...". The only menu items that do not have sub-menus are toggle items.

Remove the Pilot Menu from the display by pressing the Menu button or allowing it to time out due to inactivity.

A list and description of the menu items are shown in Table 2-1.

Table 2-1: Pilot Menu List

ITEM	DESCRIPTION
Battery Shutdown	Initiate battery shutdown. Only available when aircraft power is removed from the ESI-500.
NAV Mode	Toggle navigation display on/off. Only available when VOR/ILS or GPS Navigation configuration option is enabled.
CRS Direct To	Changes the selected course to the current VOR omnibearing. Course arrows on the heading tape also reflect current course. Only available when VOR/ILS Navigation is enabled via NAV Mode.
Set Course	Adjust the selected course value. Only available when VOR/ILS Navigation is enabled via NAV Mode.
SynVis Mode	Toggle Synthetic Vision Mode on/off. Only available when SynVis is enabled via option activation.
SynVis Gridlines	Toggle Synthetic Gridlines on/off. Only available when SynVis is enabled via option activation.
Set Brightness Offset	Adjusts display brightness in increments of 1 from 0 (lowest brightness level) to 100 (highest brightness level).
BARO Type	Select the barometric pressure unit. The options are Inches of Mercury, Hectopascals, and Millibars.
Metric Altitude	Toggle Metric Altitude readout on/off. Only available when Metric Altitude Display configuration option is enabled.
Alignment	Activates the Alignment function.
Battery Calibration	Initiate the battery calibration function. Only available when aircraft power is removed from the ESI-500.
System Status	Display the status of the following battery information: state of charge, temperature, last calibration date, and next calibration due date. It also shows aircraft effectivity.

Shutdown Procedure

1. Remove aircraft power from the ESI-500. (Battery backup is now functioning as indicated by battery icon in upper left side of display.)
2. Press Menu button. The BATT Shutdown menu item should be highlighted.
3. Press the knob to select BATT Shutdown.
4. Press the knob to Confirm.
   - Cancel can be chosen by rotating the knob until it is selected (highlighted in blue). Press the knob to return to the Menu list.

Auto Off Feature

If configured for Auto Off, the unit automatically removes power after the user configurable time (5, 40, 70 minutes) has expired. When five minutes remain in the Auto Off cycle, the pilot is given the option (see message below) to remain on battery power, otherwise the unit will shut down

PRESS MENU KEY FOR BATTERY POWER

Startup in Battery Backup Mode

1. Press and hold the Menu button for approximately 10 seconds.
2. The unit will begin normal start up showing the splash screen followed by the acknowledgement screen (if applicable).
3. Normal operation begins with the battery discharge icon showing in the upper left corner of the screen.

Battery Calibration

A controlled discharge of the indicators internal battery pack is required annually to maintain accuracy of the capacity meter. Consider the following before performing the calibration procedure:

- Read the entire calibration procedure prior to starting.
- The calibration procedure can be accomplished by the pilot/operator whenever a battery calibration is needed.
- It is required that the calibration procedure be performed anytime a battery is replaced. The calibration can be performed at anytime afterward and as often as desired in order to align the calibration with scheduled maintenance inspections or to accommodate temperature and time requirements.

- The calibration procedure can take up to 8 hours to complete.
- To assure compliance with the temperature limits of the calibration, if performing the calibration procedure on aircraft the factory recommends, in regions with hot climates, performing the procedure during the cooler months of the year and in regions with cold climates, performing the procedure during the warmer months.
- The battery discharge occurring upon entering the calibration procedure menu selection is considered part of the calibration discharge.

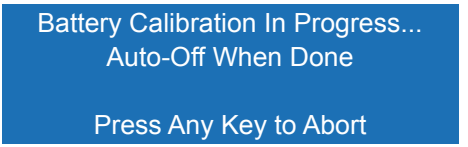
The accuracy of the battery capacity meter may degraded after about a year of standby use or storage. The indicator alerts the operator when a capacity calibration is required by displaying the following message during startup for 90 seconds (The XX is the remaining number of days until calibration is due):

BATT CAL DUE IN XX DAYS

This message continues to be displayed at each start up. On day zero (0) the “CAL DUE” battery indicator (see below) is shown on the screen during normal operation. The message and “CAL DUE” battery indicator continue to be displayed until the calibration procedure is completed.

1. Take the following into consideration before performing the battery calibration:
   - The battery SOC must be ≥ 90% before the calibration can be accomplished. Refer to charging instructions in step 5.
   - The ambient temperature of the indicator must remain between +5°C and +40°C (+41°F and +104°F) for at least 2 hours.
   - The battery must not have been in operation (charging or discharging) for at least 2 hours.
2. With no external power applied, press and hold the Menu button until the start up screen is seen (approximately 10 seconds).
   Note – This can also be done by removing external power from the indicator by placing the aircraft battery switch(s) OFF.

3. Press the Menu button.
4. Rotate the knob until Battery Calibration is highlighted in the menu bar.
5. Press the knob to Confirm battery calibration. The following screen message appears:



6. Review the following if the calibration fails.
   - The ambient temperature of the indicator must remain between +5 C and +40 C (+41 F and +104 F) during calibration.
   - If the battery SOC is not ≥ 90% the following message is shown in the middle of the screen:

   - If the battery needs to be charged. Reapply external power to the indicator. When the battery is charged to greater than 95% SOC, shut the ESI down for a rest period of 2 hours for battery stabilization. After the rest period reapply power and go to step 2 above.
   - The Cal Due battery indicator continues to be observed during normal operation if the calibration procedure is aborted.
7. When calibration is complete, the indicator automatically powers down. A 5 hour rest period is required for the battery calibration to be successful.

CAUTION

APPLYING POWER TO THE INDICATOR BEFORE THE END OF THE 5 HOUR REST PERIOD WILL INVALIDATE THE BATTERY CAPACITY CALIBRATION.

Database Update - 68DC and 71DC

The database update is needed only for units configured to use Synthetic Vision. The update of databases (68DC Obstacles/Navigation database, with worldwide or different regions available, and the 71DC Terrain database) is a pilot option. The card requirements are:

- Memory Capacity: No more than 32 GB, no less than 4 GB.
- Speed Class: 4 - 10
- Standard: SDHC
- File System: FAT32 formatted

All other card types and formats are not supported.

- Maintain the MicroSD card in a secure place in the aircraft in case it is needed by a repair station.
- Reformatting the MicroSD card prior to saving the database file to the MicroSD card will ensure minimal load time to the ESI-500.

It is the pilot/owners responsibility to make sure that the database they are using is accurate. Updates and corrections vary depending upon the effective dates of the databases. Jeppeson offers several database subscription options and update schedules. Use the following procedure to obtain a database subscription from Jeppesen:

1. Contact Jeppesen via the web at http://www.jeppesen.com/company/feedback.jsp and fill out the form or contact Jeppesen directly at 1-800-353-2107 (direct - 1-303-799-9090). Contact L-3 Avionics Systems if there are any problems.
2. A customer account will be established by Jeppesen and login credentials provided.
3. Once the order is placed, download the JDM software at www.jeppesen.com/JDM/download. The JDM software is used to update databases.

A Database Acknowledge screen is displayed after the splash screen for units with Synthetic Vision and it is used to check the following database information: Terrain database name and cycle, Terrain database effective date, Obstacle/Nav database name and cycle, Obstacle/Nav database effective date, and Obstacle/Nav database expiration date.

When loading the database files to a MicroSD card the Obstacle/Navigation database must be named “68.bin” and the Terrain database must be named “71.bin”. Note - The database files must be copied to the root directory (i.e. not in a folder) to the MicroSD card.

NOTE

The 68DC 8010-22320-0001 and 71DC 8010-23009-0001 part numbers are used by Avionics Systems for identification purposes only and are not used by Jeppesen.

Update the databases as follows:

1. With no power applied to the unit.
2. Insert a MicroSD card loaded with a database files (named 68.bin and 71.bin) in the slot on the front of the unit.
3. Apply power to the unit.
4. Press the Menu button if the Acknowledge page (if applicable) is shown.
5. Rotate the knob until Database load is highlighted and press the knob.
6. A 'Load a new database?' confirmation message is shown on the screen. Press the knob to Confirm.
7. The unit automatically cycles power and enters the Database Loading as indicated on the top of the screen
8. Rotate the knob to highlight the desired database and press the knob to select.
9. From the 'OBSTACLE/NAVIGATION' or 'TERRAIN' Database Load screen, press the knob to Confirm Load. The screen shows the 'Current' and 'Update To' database versions. A percent complete is shown at the bottom of the screen. An Update Successful message is shown at the bottom of the screen when the load is complete. The Obstacle/Navigation database takes about 1 minute to load. The Terrain database takes about 10 minutes to load.
10. After the first database load press the MENU button to return to the Database Load screen. Select the other database and perform the same procedure to load.
11. Remove the MicroSD card.
12. After databases are loaded, rotate the knob to highlight 'Exit' and press to select. The unit restarts and returns to the normal display mode.
13. Confirm the loaded databases by on the Database Acknowledge Screen during startup. Verify the cycle number and the effective date.
    - If the update did not load properly, redo the procedure. If the problem continues, contact L-3 Customer Service (800) 453-0288 or (616) 949-6600 for help in resolving the issue.

Unusual Attitude Display Operation

If an unusual attitude situation occurs navigation data and the barometric pressure digital display are removed from the display. Unusual attitude occurs as follows:

- Attitude roll is ≥ +55° or ≤ -55°
- Attitude pitch ≥ +30° or ≤ -20°

Navigation data and the barometric pressure digital display return when attitude returns to the following:

- Attitude roll is ≤ +53° or ≥ -53°
- Attitude pitch ≤ +28° or ≥ -18°

Attitude Degraded Operation

Attitude Degraded operation occurs when the normal air data aiding source is lost for three minutes, or if the Pitch or Roll value is greater than 35° for three minutes. The unit is able to continue displaying attitude information at a lesser performance. The pilot is alerted to this degraded mode of operation by an amber "ATT DEGRADED" indication on the display. Note - Heading performance is also degraded for units using the MAG-500.

- During flight, if air data is not failed and the "ATT DEGRADED" indication is displayed, cross check the attitude with another source or outside reference. Return to straight and level flight until the message clears for full performance.
- During flight , if air data is failed and the "ATT DEGRADED" indication is displayed, cross check the attitude with another source or outside reference.

Heading Degraded Operation

For installations with a MAG-500, the Heading Degraded operation occurs if the Roll value is greater than 11.5° for three minutes, or if the "ATT DEGRADED" indication is shown.

The unit is able to continue displaying heading information at a lesser performance. The pilot is alerted to this degraded mode of operation by an amber "HDG DEGRADED" indication on the display.

- During flight, if air data is not failed and the "HDG DEGRADED" indication is displayed, cross check the heading with another source or outside reference. Return to straight and level until the message clears for full performance.
- During flight, if air data is failed and "HDG DEGRADED" indication is displayed, cross check the heading with another source or outside reference.

Initiate Manual Alignment

Attitude Alignment can be manually activated using the Menu as follows:

1. Press the Menu button.
2. Rotate the knob until ATT Align is highlighted and press the knob.
3. Press the knob to Confirm.
    - Cancel can be chosen by rotating the knob until it is selected (highlighted in blue). Press the knob to return to the Menu list.

The alignment of attitude may require a couple of minutes to complete depending on the motion of the aircraft. The attitude message and progress bar remain showing on the screen until the unit is properly aligned.

During alignment, the following navigation information is removed from the screen (if applicable):

- Nav Source, To/Fr Indicator, Selected Course, Back Course Indicator, Lateral Deviation, Vertical Deviation, Marker Beacon.

NOTE

Alignment accuracy depends on current flight conditions and the ability to maintain straight and level flight throughout the alignment process. During abnormal conditions, such as high turbulence, the unit may not be able to align. The status bar may show negative progress and/or hold at zero progress until conditions improve.

Pre-Flight Instructions

1. From the Pilot Menu set the following as needed:
   - Set brightness level
   - Set barometric unit type
2. Use the bezel knob to set the barometric pressure.
3. Check that no battery indicator symbol is shown on the display.
   - If a battery indicator symbol is shown, aircraft take-off is not recommended until resolved.
4. If applicable, ensure SynVis Mode On is checked.

Check that all messages and invalidity indications have been removed.

- If messages or indications are shown, aircraft take-off is not recommended until resolved.

5. Airspeed readout shows two white dashes until the minimum airspeed display value is reached.
6. Compare the information displayed on the ESI-500 with the primary display.
   - Attitude data is within +/- 1.0°.
   - Altitude data is within +/- 20 feet (with correct baro setting).
   - Optional. Magnetic heading data is within +/- 2.0°.

In-Flight Instructions

1. When required the pilot may need to do the following:
   - Set the barometric pressure
   - Re-align attitude and heading

CAUTION *In-air alignment should only be performed during straight and level flight without acceleration.*

2. It is recommended that the SynVis mode be disabled using the Pilot menu for QNE operations above transition altitudes (18,000 ft in the United States). This is where the barometric altimeter setting is set to the standard setting of 29.92 inches of mercury, or 1013 hPa or mb. Transition levels may differ from country to country.

NOTE

The Synthetic Vision System and alerting functions use QNH (Barometric Pressure for Local altimeter Setting) operations. For QFE (Altitude Above Ground) operation the Synthetic Vision System must be disabled using the menu.

3. Set the Navigation Mode (VOR/ILS or GPS) as needed, and set the course setting as needed.
4. During loss of aircraft power the ESI-500 will continue to display attitude, altitude, airspeed, and heading (MAG-500 installations only) for approximately 1 hour. External sensor inputs such as GPS, VHF NAV functions, and ARINC 429 Heading will not be available unless an independent standby power source is provided to the sensors.

CHAPTER 3
DISPLAY FEATURES

Introduction

This chapter provides an explanation of the display features and variations based on individual aircraft configuration options chosen at installation.

This chapter provides details on the display features of the ESI-500. Included is information on available configuration options.

Attitude

Attitude information consists of an artificial horizon (sky (blue), ground (brown)), pitch ladder, roll indicator, and aircraft reference symbol. See Figure 3-1.

Configuration Options:

- Sky and ground color background with gradient shading.
- Roll indicator is either fixed (scale moves) or moveable (pointer moves).

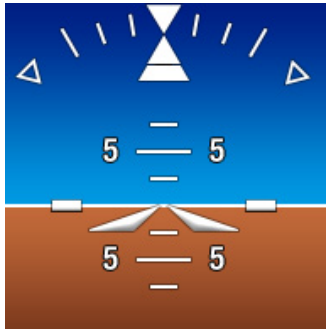


Figure 3-1: Attitude Display Features

Attitude Background

The attitude background is divided into an upper blue sky and lower brown ground with the horizon line located where the sky and ground backgrounds meet. The attitude background moves up/down and clockwise/counter-clockwise around the bore-sight of the aircraft reference symbol in relation to the pitch and roll of the aircraft.

Pitch Ladder

The pitch ladder scale is located in the center of the display with short horizontal lines positioned every +/- 2.5° and +/-7.5°, medium horizontal lines positioned every +/-5°, and long horizontal lines positioned every +/- 10°. The pitch ladder rotates around the aircraft reference symbol in relation to aircraft's roll and scrolls up and down in response to the aircraft's pitch. The scale has a maximum pitch of +/- 90°.

Pitch tape chevrons are displayed such that at least one pitch tape chevron, pointing towards the zero pitch line, is visible when the pitch tape contains pitch values (less than or equal to -25°) or (greater than or equal to 35°).

Roll Indicator

The roll indicator consists of a roll scale and a roll pointer. White scale lines are set at +/- 10°, 20°, and 30°. Hollow triangles are set at 45° and a solid downward white triangle representing the 0° mark. The roll pointer is an upward pointing triangle located on the inner arc radius of the roll scale.

The roll pointer can be configured to be fixed (scale moves) or moveable (pointer moves). The roll pointer or roll scale rotate +/- 180° around the aircraft reference symbol boresight.

Aircraft Reference Symbol

The aircraft reference symbol is fixed in the center of the display and provides a reference to determine the aircraft's pitch and roll. The aircraft is at a zero degree pitch when the horizon line intersects the aircraft reference symbol's boresight.

Slip/Skid Indicator

The slip/skid indicator is located at the base of the roll pointer and moves laterally with respect to the roll pointer proportionally to lateral acceleration. The slip indicator is depicted as a trapezoid. A displacement the width of the trapezoid (from the midpoint of the left side to the midpoint of the right side) is approximately equivalent to one ball displacement of a conventional inclinometer. The slip/skid indicator has a range of ±12°.

Attitude Invalidity

The pitch tape, roll scale, roll pointer, and slip/skid indicator are removed from the display and replaced with an attitude failure message "ATT FAIL" when invalid attitude data is detected. See Chapter 4 for details.

Airspeed

Aircraft airspeed information is provided on the left-hand side of the display and consists of an airspeed tape, airspeed digital readout, and airspeed awareness color bar. See Figure 3-2.

Configuration Options:

- Airspeed units - knots or mph.
- Tape Background - clear or semi-transparent.
- Awareness parameters.

Figure 3-2: Airspeed Display Features

Airspeed Tape

The Airspeed tape is located on the left side of the display. The tape scrolls up as aircraft speed decreases and scrolls down as aircraft speed increases. The tape has a viewing span of 80 units.

The tick marks are located every 10 units and numbered digits are located every 20 units, over the full range of the airspeed tape.

Airspeed Digital Readout

The airspeed digital readout is displayed with rolling white digits on a black background. The maximum viewing range is 300 kts or 345 mph. The readout background and digits will change color to identify set airspeed cues.

- If airspeed is greater than the max airspeed, the readout changes to a white outlined red background with white digits.
- If airspeed is greater then Vno, but less than max airspeed, the readout changes to a yellow outlined black background with yellow digits.
- If airspeed is less than Vcaution, the readout changes to a yellow outlined black background with yellow digits.

Airspeed Units Indicator

The Airspeed Units Indicator is located in the lower left corner of the display. The descriptor indicates the units being displayed on the airspeed tape and readout.

Airspeed Awareness Color Bar

The airspeed awareness color bar is located along the left side of the indicated airspeed tape. The color bar indicates critical reference airspeeds and operating ranges specific to the aircraft. See Figure 3-3, 3-4, and 3-5.

Configuration Options: Airspeed Awareness Color Bar may be configured for part 23 aircraft (V_{NE} or V_{MO}) or part 27 rotorcraft.

Part 23 Aircraft

V_{NE} (cues - V_{NE}, V_{NO}, V_{fe}, V_{s1}, V_{s0}) or V_{MO} (cues - V_{MO}, V_{fe}, V_{s1}, V_{s0}) aircraft.

In addition V_{mc} and V_{yse} may be set up for twin-engine applications.

Cues V_{fe}, V_{s1}, V_{s0}, V_{mc} and V_{yse} may be configured off.

Part 27 Rotorcraft

V_{NE} Power On, V_{NE} Power Off and $V_{CAUTION}$ (the start of the caution range for airspeed warning).

Cues V_{NE} Power Off and $V_{CAUTION}$ may be configured off.

Airspeed Invalidity

The Airspeed tape, readout, and color awareness bar are removed from the display and replaced with an airspeed failure message “IAS” when invalid airspeed data is detected. See Chapter 4 for details.

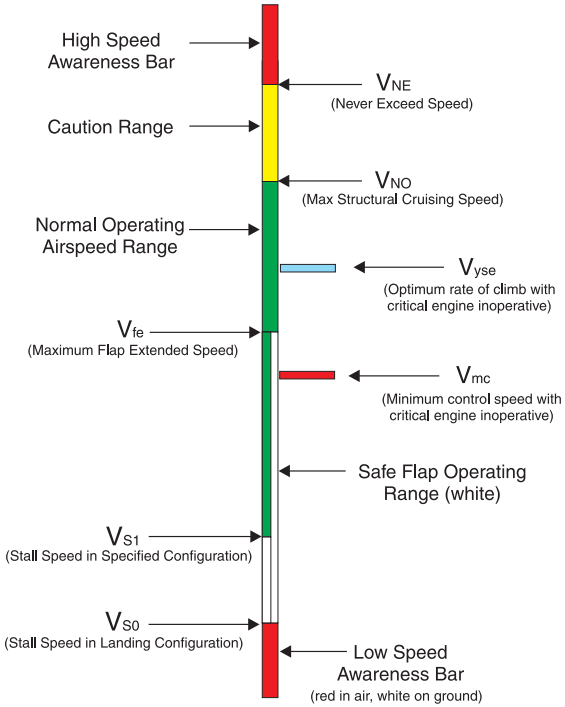


Figure 3-3: V_{NE} Awareness Color Bar Cues

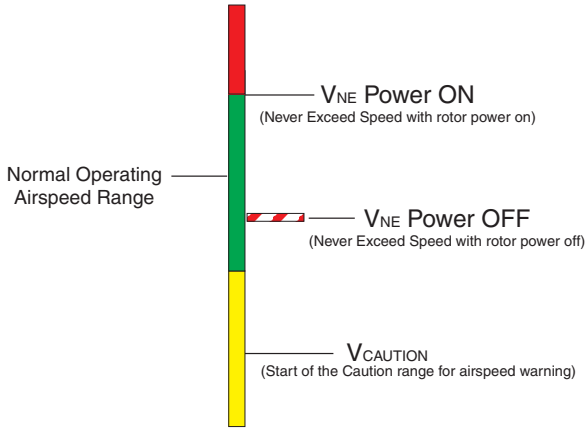


Figure 3-4: V_{NE} Power On Awareness Color Bar Cues

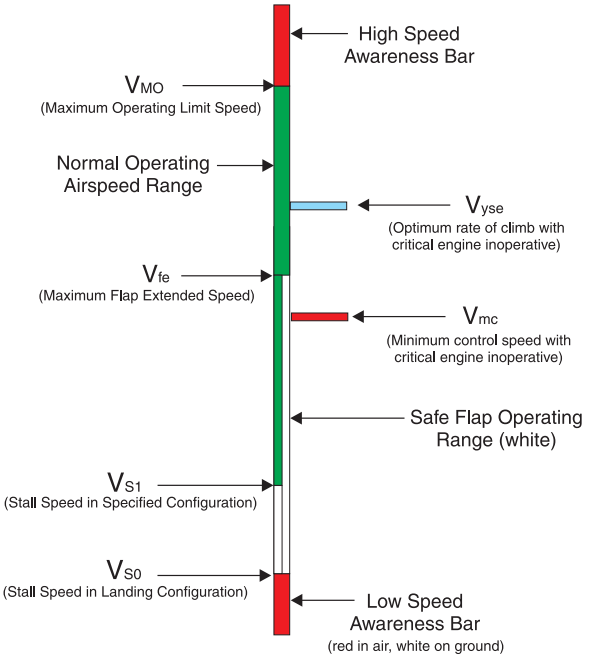


Figure 3-5: V_{MO} Awareness Color Bar Cues

Altitude

Baro-corrected altitude is provided on the right side of the display and consists of an altitude tape, altitude digital readout, barometric pressure digital readout, and optional metric digital readout. See Figure 3-6).

Configuration Options:

- Tape Background - clear or semi-transparent
- Barometric Correction Readout Color - White, Green, or Cyan
- Metric Altitude Readout - On or Off

Altimeter Tape

The baro-corrected altitude tape is located on the right side of the display. The tape scrolls up as aircraft altitude decreases and scrolls down as aircraft altitude increases. Tick marks are shown every 100 feet and numbered digits every 500 feet. The tape has a maximum viewable altitude of 1,000 feet and can go as low as -1,500 feet and as high as 35,000 feet.

Figure 3-6: Altitude, Baro, and Vertical Speed Display Features

Altitude Digital Readout

The altitude digital readout is located in the center of the altitude tape and display's the current baro-corrected altitude in feet above mean sea level (MSL). The readout can show a minimum of - 1,500 feet and maximum of 35,000 feet. A left justified minus sign is shown when altitude is less then zero. Striped boxes are shown in place of leading zeros for the thousands and ten thousands digits.

Metric Altitude Digital Readout

The metric altitude digital readout is located on the right side of the display beneath the altitude digital readout. The readout has a black background surrounded by a white box with white digits. The readout provides baro-corrected altitude in meters and has a range of -456 to 10,668 meters. A left justified minus sign is shown when altitude is less than zero.

Altitude Invalidity

The altitude tape and readout is removed from the display and replaced with a altitude failure message 'ALT' when invalid altitude data is detected. See Chapter 4 for details.

Vertical Speed

If configured, the vertical speed digital readout is located on the altitude tape below the altitude digital readout. The vertical speed digital display range is from -9900 feet per minute (FPM) to +9900 FPM. See Figure 3-6.
The vertical speed digital display digits is displayed to a resolution of 100 FPM when the magnitude of vertical speed is greater than or equal to 1000 FPM and 20 FPM when the magnitude of vertical speed is less than 1000 FPM. When the magnitude of the vertical speed is less than 60 FPM, the vertical speed indicator shows 0 FPM

An up/down direction arrow is displayed in front of the digits pointing up for positive speeds, down for negative speeds, and removed when speed is 0.
When the vertical speed is not within the normal range the readout has an amber outline and the digit and arrow color changes from white to amber.

Vertical Speed Invalidity

When invalid vertical speed data is detected, the vertical speed digital display is removed.

Barometric Pressure Digital Display

The barometric pressure digital display is located in the upper right corner of the display, above the altitude tape. The barometric pressure setting is used to correct displayed altitude for local barometric pressure.

When the Pilot menu is closed the knob is used to change the barometric pressure setting. The Barometric units can be changed using the Pilot menu. Three units are available: “in. Hg”, “hPa” and “mb”. the standard barometric pressure setting can also be set by pressing the knob. The barometric (baro) pressure ranges and standard values are shown in the table below:

Unit	Standard Value	Lowest Value	Highest Value
In. Hg	29.92	16.00	32.50
hPa	1013	542	1100
mb	1013	542	1100

Configuration Options:

- Digit Color - White, Green or Cyan

Direction Display

The Direction display will display either the aircraft magnetic heading or the aircraft magnetic track. The direction indicator is located at the bottom of the display between the airspeed and altitude tapes. The direction indicator consists of a tape and a digital readout. See Figure 3-7. When configured for MAG-500 or ARINC-429 Heading, the aircraft's magnetic heading (i.e. direction the aircraft nose is pointing) is displayed on the direction display. When configured for ARINC-429 Track, the aircraft's magnetic track over the ground provided from the GPS source is displayed.

Note - The Direction display does not display the TRUE heading or TRUE track. Only the display of magnetic heading or track is shown.

Configuration Options:

- Tape Background - clear or semi-transparent.
- Heading - On or Off.
- Direction Input - Magnetometer (MAG-500), ARINC 429 Track, or ARINC 429 Heading.

Figure 3-7: Direction Display Features

Direction Tape

The direction tape is a continuous 360° linear scale and scrolls left and right to track aircraft direction. The tape's 60° minimum span shows minor tickmarks every 5° and major tickmarks every 10°.

Numerical values show below tickmarks at 30° intervals except where "N" (360°), "S" (180°), "E" (90°), and "W" (270°) are marked. The numerical values show the tens digit for 10° to 90° and the ten and hundreds digits for 100° to 360°. The index (lubber line) is fixed at the center of the tape indicating current direction. The tape is removed whenever the menu window is opened.

Direction Digital Readout

The Direction readout is located above the direction tape. The tape has a range of 001° to 360° with a resolution of 1°.

When track is configured, the readout digits are preceded with the direction source indicator 'TRK'.

The readout is removed whenever the menu window is opened.

Heading Index

The heading index is a fixed downward pointing arrowhead located at the top-center of the heading tape. The heading index points to the current heading shown on the heading tape and provides the value shown in the heading readout.

Direction Invalidity

If configured for heading, the direction tape and readout is removed from the display and replaced with a heading failure message "HDG" when invalid heading data or excessive magnetic field dip is detected. See Chapter 4 for details.

If configured for track, the direction tape and readout is removed from the display and replaced with a track failure message 'TRK' when the computed track data is invalid or depending on the GPS source, the track failure message may be shown when the aircraft is not moving, or moving slowly. See Chapter 4 for details.

Navigation

If configured, navigation information is located in the lower portion of the display, above the heading tape. The Pilot menu is used to enable or disable navigation information from the display.

Navigation data is removed when the Pilot menu is active, when aligning attitude, or if aircraft pitch has met or exceeded +30° or -20°, or roll has met or exceeded +/- 55°.

The display of VOR data consists of a Navigation Source, Selected Course, TO/FROM indicator, Lateral Deviation Scale, and Marker Beacons. See Figure 3-8. An example of Marker Beacons is shown in Figure 3-12.

The display of ILS/LOC data consists of a Navigation Source, Selected Course, Backcourse (B/C) ILS Indicator, Lateral Deviation Scale, Vertical Deviation Scale. See Figure 3-9.

The display of GPS data consists of a Navigation Source, Desired Track (DTK) or Selected Course, TO/FROM indicator, Lateral Deviation Scale, and Vertical Deviation Scale. See Figure 3-10.

Configuration Options:

- Navigation Mode - VOR/ILS or GPS
- VOR/ILS Annunciator set to VOR/ILS or VOR/LOC, VOR/ILS1 or VOR/LOC1, VOR/ILS2 or VOR/LOC2, VOR/ILS3 or VOR/LOC3
- GPS Annunciator set to GPS, GPS1, GPS2, or GPS3
- VOR/ILS or GPS Annunciator Color - Green or Magenta

Navigation Source

Located in the lower left corner of the attitude display above the direction display, the navigation source annunciator shows the indicator's current navigation mode.

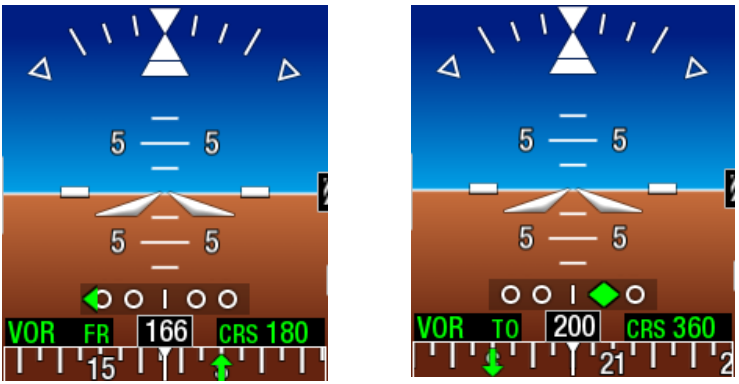


Figure 3-8: VOR Display Features

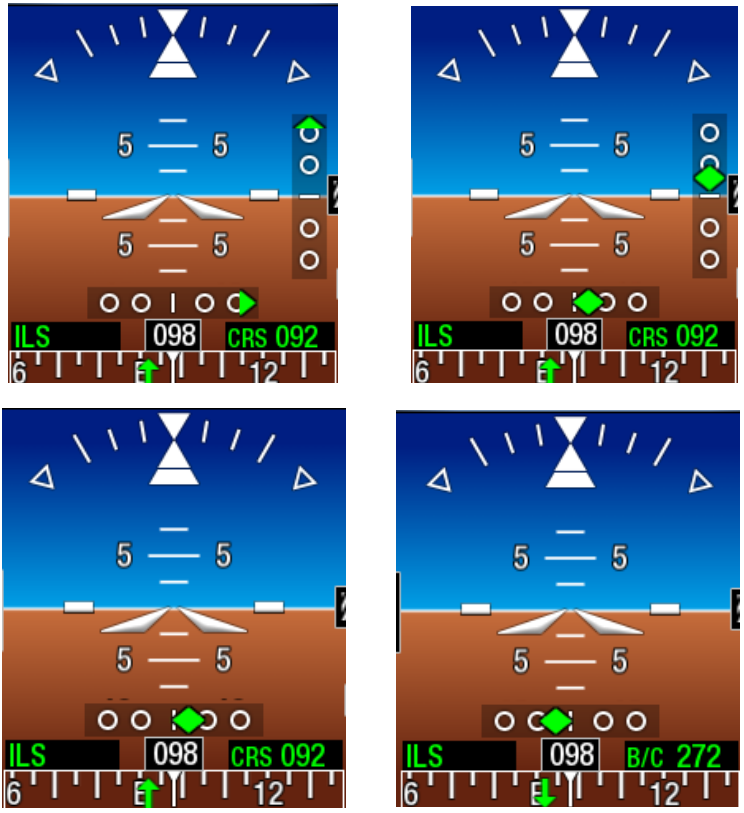


Figure 3-9: ILS/LOC Display Features

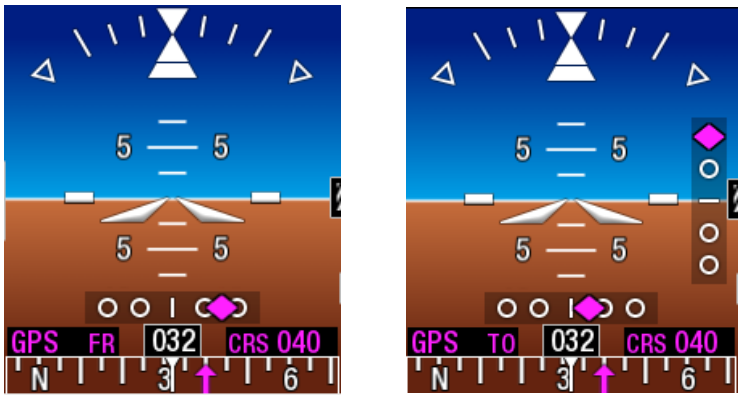


Figure 3-10: GPS Display Features

Selected Course

Selected Course is used for VOR/ILS and GPS navigation. It is located in the lower right corner of the attitude display area, above the direction display. The digits are preceded by the 'CRS' indicator.

For VOR navigation, the selected course is changed to the current VOR Omnibearing when the CRS Direct To function is activated in the Pilot menu.

Selected Course is set via the Set Course pilot menu for VOR/LOC/BC/ILS operation, but set by the GPS for GPS operation.

For Localizer and ILS navigation, the selected course should be set to the appropriate inbound course for the approach to the runway. (E.g., for a non-backcourse approach, if the inbound course for the approach to runway 27 is 270° for, then the selected course should be set to 270°.)

CAUTION

The Selected Course affects only the Navigation display on the ESI-500, and does not control the NAV receiver's OBS value (which is set from the CDI or HSI).

Because the Selected Course affects the VOR deviations, the TO/FROM flag, and the BC indications on the ESI-500, each time the NAV receiver's OBS value is changed, the Selected Course should be updated to match to avoid conflicting navigation displays.

For Localizer backcourse navigation, the backcourse annunciator 'B/C' will replace the 'CRS' descriptor when the current aircraft direction is more than 110° from the selected course when configured for Heading or Track direction display (refer to Figure 3-9).

To provide normal sensing of the lateral deviations (i.e. a displayed left deviation indicates fly left, and a displayed right deviation indicates fly right) when flying a backcourse approach, the course setting should be set to the reciprocal of the approach course. (E.g., if flying a localizer backcourse approach to runway 9, if the inbound course to Runway 9 is 090°, then the selected course should be set to the reciprocal value 270°. The ESI-500 detects the aircraft direction (090°) is opposite from the course setting (270°), and indicates the 'B/C' approach type.)

For GPS navigation, the selected course is replaced with amber dashes if the data is failed.

Selected Course Arrow

If the heading option is used and navigation is active, then the selected course arrow is shown on the direction tape. Refer to Figures 3-8, 3-9, and 3-10.

An upward pointing selected course arrow is shown at the selected course/desired track value. A downward pointing selected course arrow is shown at 180° from the selected course/desired track value.

The color of the selected course arrow is the same as the navigation information.

Note - When the GPS navigator is operating in 'True North' mode, the ESI-500 displays the true DTK or CRS value followed by a 'T', and the Selected Course arrow is removed from the Direction Tape."

Desired Track

Desired Track is used for GPS navigation to provide the intended track to a waypoint. The 'DTK' is the normal indicator when flying a GPS active leg. The 'CRS' indicator replaces the 'DTK' indicator when the GPS is operating in CRS mode (sometimes referred to OBS mode). Refer to the GPS manual for more information.

The Desired Track is replaced with amber dashes if the data is failed.

TO/FROM Indicator

The 'TO' / 'FR' indication is located to the right of the navigation source annunciator, in the lower left corner of the attitude display area. This indication is a VOR and GPS function. Refer to Figures 3-8 and 3-10.

In GPS mode, the To/From indicator shows the GPS navigation mode to or from the waypoint.

In VOR mode, the To/From indicator shows the aircraft's relationship to the selected course.

In VOR mode, the 'TO' indicator is displayed when the selected course is $\leq$ 85° from the relative bearing to the VOR. The 'TO' indicator is replaced by the 'FR' indicator when the selected course becomes $\geq$ 95° from the relative bearing to the VOR. See Figure 3-11 (A).

In VOR mode, the 'FR' indicator is displayed when the selected course is $\geq$ 95° from the relative bearing to the VOR. The 'FR' indicator is replaced by the 'TO' indicator when the selected course becomes $\leq$ 85° from the relative bearing to the VOR. See Figure 3-11 (B).

In VOR mode, the To/From indicator and the lateral deviation indicator may be removed while the VOR omnibearing signal is unavailable, such as when passing over the VOR station.

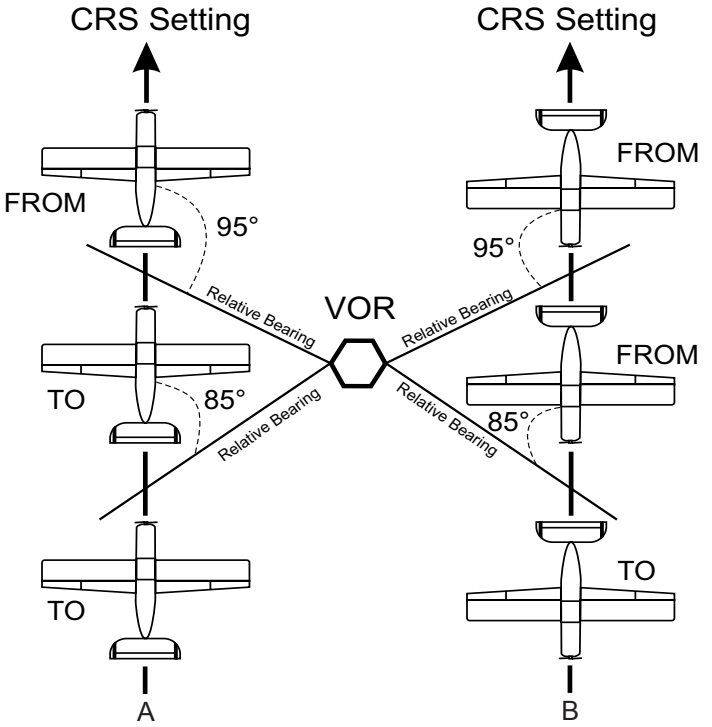


Figure 3-11: Examples of VOR TO/FROM Transition

Marker Beacon

If the NAV receiver provides Marker Beacon information to the ESI-500 the VOR/ILS marker beacons are located towards the top right corner of the attitude display area. When the marker beacon receiver detects passage over a radio beacon, the corresponding marker beacon flashes on the display: cyan 'O' (Outer Marker), yellow 'M' (Middle Marker), or white 'I' (Inner Marker). See Figure 3-12.

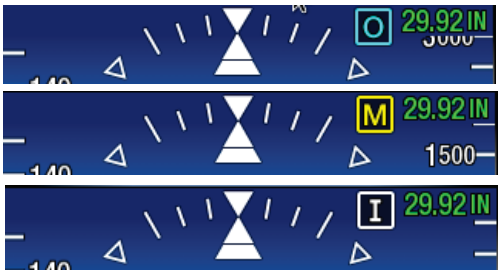


Figure 3-12: Example of Marker Beacon

Lateral Deviation Indicator

The lateral deviation indicator is used for VOR, Localizer, and GPS guidance. It is centered in the lower attitude display area below the pitch ladder. The indicator consists of a lateral deviation scale and diamond shaped pointer. Refer to Figures 3-8, 3-9, and 3-10.

The color of the deviation pointer is the same as the navigation information. If the deviation scale is exceeded the deviation pointer remains fixed at the far edge of the scale.

The lateral deviation pointer is centered in the middle of the lateral deviation scale when the lateral deviation is tracking to the desired course. The lateral deviation pointer will deflect right of center for positive lateral deviations and deflect left for negative lateral deviations.

The ILS BC mode reverses the lateral deviation so that a backcourse may be flown such that a displayed left deviation indicates fly left, and a displayed right deviation indicates fly right. The BC mode only applies if the Direction display of heading or track is configured. Refer to Figures 3-9. (E.g., for a localizer backcourse approach to runway 9, if the inbound course to Runway 9 is 090°, then the selected course should be set to the reciprocal value 270°.) The ESI-500 detects the aircraft direction (090°) is opposite from the course (270°), and indicates the ‘B/C’ approach type.

The lateral deviation pointer is removed and a red ‘X’ is drawn over the lateral deviation scale, when data being received from the navigation receiver is missing or failed.

Vertical Deviation Indicator

The vertical deviation indicator is used for Localizer and GPS guidance. It is not shown when ILS BC mode is active, or for enroute GPS navigation, or GPS approaches providing lateral guidance only. It is centered on the right side of the attitude display area. The indicator consists of a vertical deviation scale and diamond shaped pointer. Refer to Figure 3-9 and 3-10.

The color of the deviation pointer is the same as the navigation information. If the deviation scale is exceeded the deviation pointer remains fixed at the far edge of the scale.

The vertical deviation pointer is centered in the middle of the vertical deviation scale when the vertical deviation is tracking to the desired course. The vertical deviation pointer will deflect below center for positive vertical deviations and deflect above center for negative vertical deviations.

When the 'B/C' annunciator is displayed, the vertical deviation indicator is removed.

The vertical deviation pointer is removed and a red 'X' is drawn over the vertical deviation scale, when data being received from the navigation receiver is missing or failed.

Synthetic Vision System

If configured, synthetic vision system takes the place of the standard blue over brown attitude background showing the front window synthetic view of surrounding terrain, water, and obstacles alerts, centered on true heading. See Figure 3-13.

Synthetic vision can be toggled On/Off using the Pilot menu.

The field of vision has a span of 48° with a horizon range of 40 nm. The obstacles greater than 200ft above ground level are displayed.

The synthetic vision option uses terrain data from the 71DC Terrain database. It also uses obstacle data from the 68DC Navigation database.

The Synthetic Vision System and alerting functions use QNH (Barometric Pressure for Local altimeter Setting) operations. For QFE (Altitude Above Ground) operation the Synthetic Vision System must be disabled using the menu.

It is recommended that the SynVis mode be disabled using the Pilot menu for QNE operations above transition altitudes (18,000 ft in the United States). This is where the barometric altimeter setting is set to the standard setting of 29.92 inches of mercury, or 1013 hPa or mb. Transition levels may differ from country to country.

NOTES

QNH is the barometric altimeter setting that causes an altimeter to read airfield elevation above mean sea level when on the airfield.

QFE is the barometric altimeter setting that causes an altimeter to read zero when at the reference datum of a particular airfield (in practice, the reference datum is either an airfield center or a runway threshold).

Figure 3-13: Synthetic Vision Display Features

WARNING

The synthetic vision attitude background including terrain display, obstacles, and terrain alert coloration are for situational awareness to aid in visual acquisition of terrain and obstacles only and should not be used for terrain avoidance, navigation, or as a primary means of terrain alerting.

The synthetic vision function is available within 90 seconds of receiving position and orientation information. A synthetic vision acquiring message (SVS xx%) is shown on the display. See Figure 3-14

Figure 3-14: SVS %

Grid line Overlay

Grid lines can be displayed over the synthetic vision terrain. The lines are spaced 1 nautical mile apart in the north-south and east-west directions (true north referenced).

Grid lines help with identifying distance, contours, and relative motion. The Grid line overlay can be toggled On/Off using the Pilot menu. See Figure 3-15.

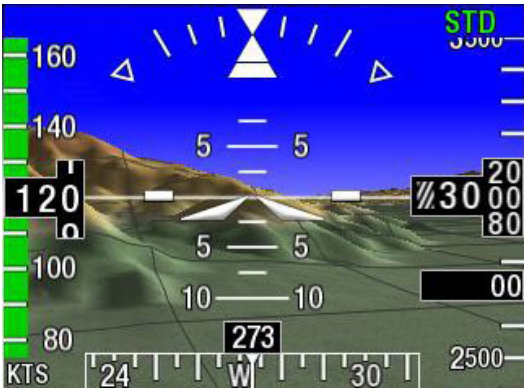


Figure 3-15: Example of Grid Line Overlay

Terrain Alert

Two types of terrain alerts are shown on the synthetic vision display: caution alerts and warning alerts.

The caution alert is shown when a hazard is detected within 60 seconds of the aircraft current flight path (see below). The object causing the alert will be highlighted in yellow on the synthetic vision display. This alert requires immediate corrective action. See Figure 3-16.

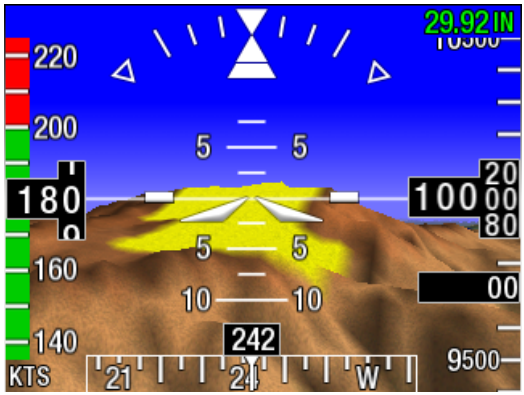


Figure 3-16: Terrain Caution Alert

The warning alert is shown when a hazard is detected within 30 seconds of the aircraft current flight path (see below). The object causing the alert will be highlighted in red on the synthetic vision display. This alert requires immediate corrective action. See Figure 3-17.

Figure 3-17: Terrain Warning Alert

Obstacles Alert

Man-made obstacles are shown as black rectangular boxes with white outlines. The height of an obstacle symbol corresponds to the height of the obstacle, but the horizontal dimensions of the obstacle symbol correspond to an obstacle 150 ft wide by 150 ft deep regardless of the actual horizontal dimensions of the obstacle.

Only obstacles with heights greater than or equal to 200 ft are displayed. When an obstacle generates an obstacle alert, the corresponding synthetic vision obstacle symbol will be colored amber for a caution alert or red for a warning alert. See Figure 3-18.

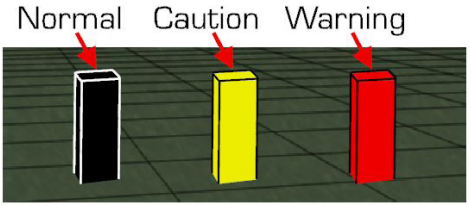


Figure 3-18: Obstacle Alerts

WARNING

Synthetic Vision provides situational awareness to the pilot by providing a means to aid in visually acquiring potential impact threats of terrain and obstacles, however, the database may not contain all obstacles; therefore, be aware that obstacles may be approached that are not shown on the synthetic vision display. If is the pilot's responsibility to be familiar with all potential obstacles for the planned route by reviewing all available charts, NOTAMs and emergency updates prior to flight.

Synthetic Vision Terrain Alerting Function

The Synthetic Vision Terrain Alerting function looks ahead of the aircraft projected vertical and horizontal flight path, including turns, to determine if any terrain or obstacles might pose a threat. (Hereafter the word “terrain” refers to “terrain or obstacles” unless indicated otherwise.) The ESI-500 Synthetic Vision Terrain Alerting function determines the terrain threat based on the phase of flight (Figure 3-19) and on the predicted terrain clearance compared to the required terrain clearance (Tables 3-1 & 3-2). Alerts are disabled within the area 1.2 nmi around the runway and 500 ft above the runway threshold when you are landing to prevent nuisance alerts.

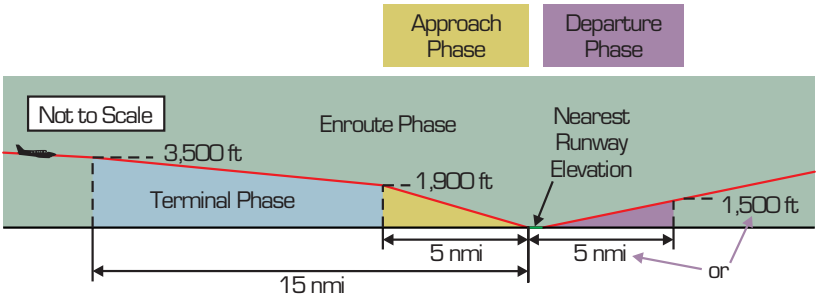


Figure 3-19: Phase of Flight Definitions

Reduced Required Terrain Clearance (RTC)

The reduced RTC alert condition occurs when your aircraft is currently above the altitude of the upcoming terrain along the projected flight path, but the projected terrain clearance is less than the required terrain clearance for the phase of flight (Figure 3-20 and Table 3-1). The ESI-500 issues a caution alert 60 seconds before the offending terrain and a warning alert 30 seconds before the offending terrain. See Table 3-1 for other phase options for phase of flight clearance limits.

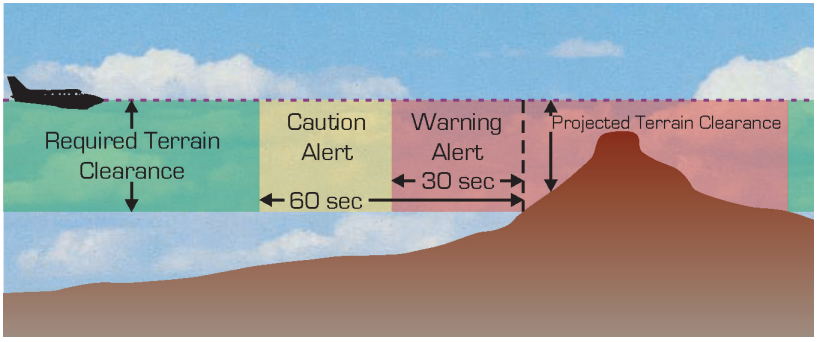


Figure 3-20: Reduced RTC Alert Condition

Phase of Flight	Level or Ascending Flight	Descending Flight
Enroute	700 ft	500 ft
Terminal	350 ft	300 ft
Approach	150 ft	100 ft
Departure	100 ft	100 ft

Table 3-1: Required Terrain Clearances for the Reduced RTC Alert Condition

Imminent Terrain Impact (ITI)

The ITI alert condition occurs when your aircraft is currently below the altitude of the upcoming terrain along the projected flight path, and the projected terrain clearance is less than the required terrain clearance (Figure 3-21 and Table 3-2). The ESI-500 issues a caution alert 60 seconds before the offending terrain and a warning alert 30 seconds before the offending terrain. See Table 3-2 for other phase options for phase of flight clearance limits.

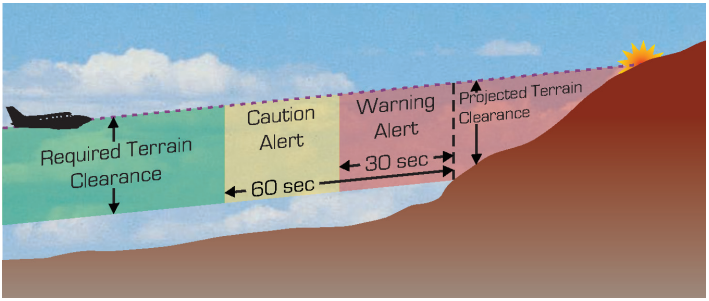


Figure 3-21: ITI Alert Condition

Phase of Flight	Required Terrain Clearance
Enroute	700 ft
Terminal	350 ft
Approach	150 ft
Departure	100 ft

Table 3-2: Required Terrain Clearances for the ITI Alert Condition

WARNING

The ESI-500 does not know where the pilot intends to land, therefore it calculates alerts based on the aircraft proximity to the closest airport and measures the distance from that airport once per second. The closest airport may or may not be the airport where the pilot intends to land. Failure to understand this logic may cause you to misinterpret alerts or the lack of alerts.

Synthetic Vision Invalidity

When position and orientation data is invalid or if the aircraft is not within the valid coverage area (+/- 70 Latitude) of the 71DC Terrain database, the synthetic vision function is removed from the display and a fail message (amber 'SVS') is shown along with the standard blue over brown attitude background. See Figure 3-22.

Figure 3-22: SVS Invalidity

NOTE

Garmin GNS 400W/430W and 500W/530W (WAAS) units output simulated position data when the Panel Self Test page is active. This causes ESI-500 SVS position to display at the simulated position, and possibly cause an Alert. Do not use the ESI-500 SVS function while the GPS is in the Panel Self Test Page.

CHAPTER 4
MESSAGES AND INDICATIONS

Introduction

Messages and indications provide functional status of a display feature or the unit in general. Messages or indications can be shown on the splash screen, system status screen (battery status), or on the normal operation screen.

Before removing the unit or its system components from the aircraft contact L-3 Customer Service Avionics Systems authorized service center or Avionics Systems Customer Support at (800) 453-0288).

Display Conditions

Figure 4-1 shows the possible invalidity indications. Table 4-1 provides a list of indications and possible display conditions with a description and any corrective action.

The ALT, ATT FAIL, IAS, HDG, ATT DEGRADED, and HDG DEGRADED invalidity flash on/off for 5 seconds and then remains on. The invalidity is removed when the condition is resolved.

It is recommended to crosscheck other cockpit displays/instruments for errors and/or data inconsistency.

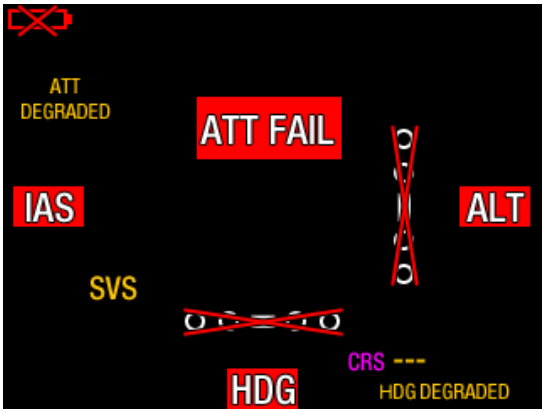


Figure 4-1: Display Invalidities

Table 4-1: Indications and Display Conditions

CONDITION	CAUSE/CORRECTIVE ACTION
'ALT' invalidity is shown on the right side of the screen with the altitude tape, altitude digital readout, vertical speed, and metric altitude digital readout removed from the screen.	Invalid altitude data is detected. 1. The air data sensor may need to warm up. Expect up to 3 minutes to warm up at colder temperatures. The ALT invalidity will be shown at this time. 2. If invalidity continues, cycle power to the system.
'ATT FAIL' invalidity is shown on the center of the screen with the pitch tape, roll scales, roll pointer, and slip/skid indicator removed from the screen.	The attitude data required to compute attitude is invalid. 1. Cycle power to the system. (Ensure aircraft is not moved during the alignment period). 2. During flight only. The rate of motion of the indicator exceeding 300 degrees per second (in any axis). Attitude will re-align when rate of motion is less than 300 degrees.
'HDG' invalidity. The heading tape and readout are removed from the screen. Note – Heading is invalid during alignment for units configured to use a MAG-500.	The data required to compute heading is invalid. 1. Cycle power to the system. 2. The aircraft may be in an excessive dip angle zone. Heading will return after dip angles return to normal. 3. Invalid Air Data will cause the heading invalidity. 4. Check the external heading source for an error.
'IAS' invalidity is shown on the left side of the screen with the airspeed tape, speed awareness bar, and digital readout is removed from the screen.	Air data is invalid. 1. The air data sensor may need to warm up. Expect up to 3 minutes to warm up at colder temperatures. The IAS invalidity will be shown at this time. 2. If invalidity continues, cycle power to the system.

Table 4-1: Indications and Display Conditions

CONDITION	CAUSE/CORRECTIVE ACTION
When the unit is set to display GPS Navigation. The DTK value is (---) with amber text and a red X over the deviation scale.	GPS data is missing or failed. 1. Cycle power to the system. 2. Check cockpit instrumentation, if the track data is missing, a problem may exist with the navigation device.
When the unit is set to display VOR/ILS or GPS Navigation. The CRS value is (---) with amber text and a red X over the deviation scale.	Navigation data is missing or failed. 1. Cycle power to the system. 2. Check cockpit instrumentation, if the course data is missing, a problem may exist with the navigation device.
When the unit is set to display VOR/ILS Navigation and a red X over the deviation scales.	VLOC data is missing or failed. 1. Cycle power to the system. 2. Check cockpit instrumentation, if the VLOC data is missing, a problem may exist with the navigation device.
Vertical Speed readout missing.	Vertical speed data is removed or missing from the screen. 1. The air data sensor may need to warm up. Expect up to 3 minutes too warm up at colder temperatures. 2. Cycle power to the system. 3. Readout may not be selected as a configuration option. 4. If data continues to be missing, replacement of indicator may be required.
Nothing displayed on indicator after power applied.	Check the following: 1. Press and hold the Menu button to increase display brightness. 2. Verify Battery (BAT) Master switch is on. 3. Check breakers and main avionics switch. 4. The unit may have experienced a hardware failure. Replacement of indicator may be required

Table 4-1: Indications and Display Conditions

CONDITION	CAUSE/CORRECTIVE ACTION
The amber 'ATT DEGRADED' indication is shown in the upper left corner above the IAS tape.	The unit shifts into the Attitude Degraded Mode due to the following: 1. A loss of air data for three minutes will cause the ATT DEGRADED indication. When air data becomes valid, the 'ATT DEGRADED' indication is removed. 2. An Attitude Roll greater than 35° for 3 minutes will cause the ATT DEGRADED indication. • See page 2-11 for In-flight instructions. • Cycle power to the unit if the indication does not get removed. Replacement of indicator may be required.
The amber 'HDG DEGRADED' indication is shown on the right side of the heading tape.	The unit shifts into the Heading Degraded Mode due to the following: 1. 'ATT DEGRADED' indication is shown for installations with a MAG-500. 2. An Attitude Roll greater than 11.5° continuously for 3 minutes. • See page 2-11 for In-flight instructions. • Cycle power to the unit when convenient. If the indication does not get removed. Replacement of indicator may be required.
'BATT WORN OUT... REPLACE' message is displayed on screen during startup.	The battery pack can no longer hold a state of charge greater than 1 hour and requires replacement. • Have indicator checked by Avionics Systems authorized dealer.

Table 4-1: Indications and Display Conditions

CONDITION	CAUSE/CORRECTIVE ACTION
Obvious heading difference is observed between the indicator and the primary display.	Heading error caused by bad input data. 1. Cycle power to the indicator and the external source device. 2. If heading information continues to be different between the displays, use a third heading device to determine which device is correct. 3. If a MAG-500 is part of the system, check for magnetic interference around MAG-500. 4. Replacement of the indicator or external source device may be required.
Navigation information missing from indicator screen.	The navigation data has not been activated through the Pilot menu or the data is invalid. 1. Press Menu button on indicator and rotate the knob to Navigation Mode menu item. Press the knob to activate. 2. The navigation option may not be active. 3. The navigation input may not be providing valid data. Cycle power to the system. 4. Replacement of indicator or external equipment may be required.
Heading tape and digital readout missing when performing dynamic flight patterns.	Heading tape and digital readout are removed from the display if roll angle is > +102° or < -102°.
Metric digital readout is missing.	1. Not activated from the Pilot menu. Press the Menu button and select metric readout on. 2. Readout may not be selected as a configuration option.

Table 4-1: Indications and Display Conditions

CONDITION	CAUSE/CORRECTIVE ACTION
The amber 'SVS' indication (Synthetic Vision System) is shown on the screen.	The SVS indication is shown on the screen for any of the following reasons: • Loss of external GPS data. • Loss of or Failed Heading. • Failed Attitude or Air Data. • Failed or missing Databases. • Failed or loss-of OAT information. 1. Cycle power to the system. 2. Check external sources for error. 3. Replacement of the indicator or external source device may be required.
A Data Configuration Module error message is shown on the splash screen during start up.	A problem has been detected with the Data Configuration Module (DCM-500) or the files it contains. 1. Cycle power to the indicator. 2. If problem continues replacement of indicator or DCM-500 may be required.
The Terrain or Obstacle database fails to initialize on the Synthetic Vision Acknowledge screen.	1. The database can take up to the 30 seconds to initialize. 2. Reload the database that failed to initialize (see Chapter 2 for details).
Battery Failed indicator (red). 	The battery is not operating correctly and a failure has been detected. 1. Cycle power to the system. If the red battery failed indicator continues to be observed after power cycle refer to step 2. 2. The battery requires replacement. Contact an Avionics Systems authorized dealer. 3. If battery is replaced and fault is still detected the unit may be defective.

Table 4-1: Indications and Display Conditions

CONDITION	CAUSE/CORRECTIVE ACTION
Battery RTC Icon 	The real time clock needs to be set. • Contact an Avionics Systems authorized dealer.
Battery not available (amber). 	Battery operation (charge and discharge) is not possible due to high temperature conditions or low battery voltage. 1. Check the Pilot Menu Battery Status. 2. Allow the battery to cool down. 3. Cycle power to the system. 4. The amber battery icon is removed when the battery returns to normal operating conditions.
Battery Fault 	Battery charging is not possible due to a cell over voltage. 1. Cycle power to the system. If the fault indicator continues to be observed after power cycle refer to step 2. 2. The battery requires replacement. Contact an Avionics Systems authorized dealer. 3. If battery is replaced and fault is still detected the unit may be defective.
Battery Charge Inhibited 	A low voltage power input is inhibiting battery charging. 1. If problem continues check aircraft power input to the unit (14VDC or 28VDC per configuration option). 2. Cycle power to the system. 3. If problem continues replacement of indicator may be required.

Battery Indications

Battery indicators and messages are located on the top-left side of the display. The indicators provide details on the general state of charge (SOC), availability of the battery for discharge or charge, battery failure, notifications

Table 4-2 provides brief description and examples of common battery indicators. Status messages provide details on battery calibration and how to continue operating the indicator using the backup battery.

During normal operation (unit powered by aircraft power and the battery has at least 1 hour of run time) no battery indicator or message is shown on the display.

Contact an Avionics Systems authorized dealer for battery replacement or calibration.

NOTE

It is important to note that the battery indicator is an indication of the battery's relative state of charge and is independent of the 1 hour run time expressed by the color of the battery indicator. As the life of the battery ends, the charge capacity of the battery gradually reduces to the point that the battery indicator shows 100% SOC, but is colored amber indicating less than 1 hour run time. If this condition is observed, then the battery is worn out and requires replacement.

Table 4-2: Battery Indications

BATTERY INDICATORS	DESCRIPTION
Discharge Indicators	
The run time capacity for a green battery indicator is at least 1 hour. *The run time capacity for an amber battery indicator is less than 1 hour.*	
	Battery is discharging and has a SOC > 90%.
	Battery is discharging and has a SOC ≤ 90% but > 65%.

Table 4-2: Battery Indications

BATTERY INDICATORS	DESCRIPTION
	Battery is discharging and has a SOC ≤ 65% but > 40%.
	Battery is discharging and has a SOC ≤ 40% but > 15%.
	Battery is discharging and has a SOC ≤ 15%.
Charge Indicator	
	Battery is currently charging and has less than 1 hour (run time). Note: Depending on SOC this indicator can be shown less than filled.
Availability Indicators	
	Battery operation (charge and discharge) is not possible due to high temperature conditions or low battery voltage. Battery discharge functionality returns to normal when the temperature is less than +60°C (+140°F) or battery voltage increases to normal voltage levels.
	An unrecoverable failure of the battery system is detected. Battery operation, charge and discharge functions are unavailable. If icon continues to be seen after cycling power to the unit a battery replacement may be required. .
	Battery is unable to charge due to low voltage power input. Note: Depending on SOC this indicator can be shown less than filled.

Table 4-2: Battery Indications

BATTERY INDICATORS	DESCRIPTION
	Battery charging is not possible due to a cell over voltage. The icon is removed if condition corrects. If icon continues to be seen after a cycling power to the unit a battery replacement may be required.
NOTIFICATION INDICATORS	
	The accuracy of the battery capacity meter may be degraded and require a calibration discharge cycle. The battery charging and discharging continues to work, but the battery capacity is unknown. A battery calibration is required to remove this indicator from the screen. Contact an Avionics Systems authorized dealer.
	The real time clock needs to be reset. The battery charging and discharging continues to work, but until a reset is performed battery capacity may not be accurate. Contact an Avionics Systems authorized dealer.
	The battery has reached its end of life and cannot provide the required 1 hour run time. The battery charging and discharging continues to work. Battery replacement is needed. Note – Depending on SOC this indicator can be shown less than filled.
	When the battery temperature is < -20°C (< -4°F), indicating that battery capacity is not guaranteed, or when the battery needs to charge but the battery temperature is < +5°C or > +40°C (< 41°F or >104°F)

APPENDIX A

Record Of Important Information

Dealer Information

Name_____

Address_____

City, State, Zip_____

Telephone_____

Equipment Information

Date of Purchase_____

Installation Date_____

Model Number_____

Part Number_____

Serial Number_____

Mod Letter _____

Release _____

Aircraft Information

Aircraft Make_____

Aircraft Model_____

Serial Number_____

N Number_____

Register this product online at:
www.l-3avionics.com/customercare/warrantyregistration

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Avionics Systems

L-3 Avionics Systems
5353 52nd Street, S.E.
Grand Rapids, MI USA 49512-9704
Telephone (800) 453-6600
International (616) 949-6600
www.L-3avionics.com

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